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June 24, 2016
Project No. 8128.02.01

Dana Bayuk
Oregon Department of Environmental Quality
700 NE Multnomah Street, Suite 600
Portland, Oregon 97232

Re: Siltronic Comments on NW Natural Groundwater Model Recharge Rate Adjustment

Dear Mr. Bayuk:

On behalf of Siltronic Corporation (Siltronic), Maul Foster & Along, Inc. (MFA) has prepared the following letter providing comments on the recently proposed adjustment to input parameters of the NW Natural (NWN) groundwater model of the Siltronic and Gasco properties (the site). At the Department of Environmental Quality's (DEQ's) request, NWN elected to incorporate a higher precipitation recharge rate into pervious (i.e., unpaved) areas of the site. The adjustment increased recharge from precipitation from 20% to 50%—that is, 50% of the rain that falls on unpaved areas is assumed to recharge groundwater at the site. Using this parameter, DEQ provided approval for NWN to move forward with model calibration.

MFA reviewed correspondence between NWN and DEQ and has provided the following comments regarding DEQ's recent approval (request).

- It is not clear that the hydrogeologic conceptual site model (CSM) and the MODFLOW model setup accurately reflect the connection (or lack thereof) between the Fill WBZ and the Alluvium.
- Measured values, especially measured hydraulic-conductivity values, should be prioritized over maintaining an estimated recharge rate during model calibration. Observed spatial variability in Fill hydraulic conductivities should be incorporated into the model.
- Applying a single recharge rate to multiple pervious surfaces at the site does not adequately capture the variation in unpaved surfaces present at the site. Different recharge values should be used for vegetated and non-vegetated pervious areas.

Details of these technical comments are provided below.

Conceptual Hydrogeological Model

In the 2014 groundwater model update report,[1] NWN's discussion of the recharge rate used in the model indicates that the impact of changes in the recharge rate is dependent on the degree of hydraulic connectivity between the Fill and Upper Alluvium water-bearing zones (WBZs). The report states that "If the Fill and Upper Alluvium WBZs are not strongly connected, the recharge rate will have little effect on the capture zone." If the Fill WBZ is separated from the Alluvial WBZ by a silt aquitard, then recharge to the Alluvium WBZ from site precipitation would be minor to absent. If the gaps observed in the silt aquitard result in some degree of hydraulic connectivity between the two units, the recharge rate used in the model will impact the water-level response, and the volume of water captured by the HCC system.

The groundwater model update report suggests that the degree of hydraulic connectivity between the two units is unknown. This hydraulic connectivity is important for understanding recharge to the Alluvium, and also evaluation, selection, and design of Fill WBZ source-control measures. MFA recommends that DEQ and NWN resolve this component of the hydrogeological conceptual site model consistent with the MODFLOW groundwater model.

Hydraulic Conductivity Measurements and Model Calibration

In April 2016 NWN performed additional field measurements of anisotropic K values using single-well pump tests and during model calibration intends to adjust Fill-WBZ K values "within the measured range." On June 14, 2016 MFA received the results of single-well pump tests performed by NWN at Fill water-bearing zone (WBZ) wells located at the Gasco and Siltronic properties.[2] The measured Fill-WBZ hydraulic conductivities were found to be highly variable, ranging between 0.03 and 120 feet per day (i.e., four orders of magnitude).

Given this large range of values, representing the hydraulic conductivity of the Fill WBZ with a single value is not appropriate. MFA recommends that NWN represent this observed variability in the groundwater model by incorporating the measured K values as spatially variable input parameters in the Fill WBZ.

MFA agrees that calibrating the model to the Fill-WBZ groundwater elevations (i.e., the calibration targets) is appropriate. Adjusting input parameters (in this case, recharge and K) may also be an appropriate approach for achieving the calibration targets. However, the selected and arbitrary recharge value should not take precedence over the measured K values

[1] Anchor QEA, LLC. 2014. Revised Final Hydraulic Source Control and Containment System Groundwater Model Update Report, NW Natural Gasco Site. Prepared for NW Natural. August.

[2] Anchor QEA, LLC. 2016. Memorandum Re: Single Well Pumping Tests in Fill Water Bearing Zone Monitoring Wells at the NW Natural Gasco Site. June 13.

from the field tests. The measured K values from the field tests should be used and applied as noted above.

MFA is concerned that K values that are increased to reach calibration targets, as a result of an arbitrary adjustment of recharge, will result in overestimation of groundwater transmissivity in the Fill WBZ, which could in turn impact evaluation, selection, and design of Fill WBZ source-control measures.

Single Recharge Rate

MFA believes that use of a single recharge rate for all pervious surfaces at the site is not representative of actual site conditions. The site contains a range of pervious surfaces, ranging from compacted gravel to undeveloped vegetated areas. As a result of much higher evapotranspiration rates, recharge rates in vegetated areas are likely to be lower than in other unpaved areas. MFA recommends that NWN determine the percentage of pervious surface that is vegetated versus non-vegetated and incorporate appropriate recharge/evapotranspiration/interception rates for these areas.

Please do not hesitate to call or email if you have any questions regarding these comments.

Sincerely,

Maul Foster & Alongi, Inc.

Michael R. Murray, RG, EIT
Project Environmental Scientist

James G.D. Peale, RG
Principal Hydrogeologist

cc: (electronic)
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